Fermilab

Beams Division Headquarters

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To: Aesook Byon-Wagner

From: Phil Martin

Subject: NuMI Beam Design Parameters Review, 7/13/01

The beam loss budget is of course the most challenging aspect here. To this end, the studies discussed by A. Marchionni are extremely important. In addition to some of the items he discussed, measurements of the beam momentum spread are necessary. Along with the ACNET parameter for the bunch length, I:BLMON, the actual beam signal from which this is derived should be looked at. While this cannot be datalogged or fast-time-plotted, it contains much pertinent information on tails in E-t space, and bunch-to-bunch fluctuations. As I mentioned during the review, using 3-bumps in the P1 and P2 line to study tails and calibrate the BLMs will prove to be a useful tool, I suspect. I would be happy to meet with the NuMI people who will be working on these studies to help plan things further. As mentioned during the review, the Main Injector Dept. is extremely busy, and therefore NuMI personnel are going to have to take responsibility for these studies with minimal support from MID. But it is important to carry these studies out soon, to help set the specs on momentum stability, pulse to pulse and bunch to bunch.

Apart from the studies with the MI beam and beamlines, design studies should continue for the NuMI beamline to verify that there are not combinations of mistunings of several power supplies that can in fact strike the beampipe in the carrier tunnel. Also, pursue a design of two scrapers per plane to clean up any beam tails or halo at a location where losses of a few percent can be tolerated. If the tails are already there coming out of the Booster, could they be cleaned up in the MI-8 line? Or would they grow again during acceleration? More studies!

The beam position monitor system has to work reliably both during commissioning and operations. It must also work at both low intensity for commissioning and at high intensity for operations. Switchable amplifiers or attenuators may be required.

For the physical layout of the NuMI beamline, I would recommend the addition of two vacuum valves (these could be hand-valves), one on each side of the beampipe that otherwise

blocks vehicular access to the A1 line or NuMI stub. This would allow removal of the beampipe without letting up the section of NuMI beamline closest to the Main Injector. This will minimize the impact on MI vacuum following the need for access. Because there is no vacuum window separating the beamline from the MI vacuum system, the design goal should be substantially better than 10^{-7} Torr, not the 10^{-6} Torr presented at the review. Further, the NuMI management should make a strong case for getting that section of beamline completely installed and under vacuum at least a year before first beam, along with taking the necessary steps before and during installation to achieve the higher vacuum levels desired. I realize that the installation cannot be completed right now, due to the interference with the Recycler, but that should be able to corrected sometime in the year or so following the fall shutdown. A reasonable goal would be to get your beamline under vacuum in 2003. This would be an appropriate time for the Lambertsons to be installed as well. On a somewhat related matter, the placement of kickers, needs to be firmed up with the Main Injector department, both in the case of two long kickers or three shorter kickers.

Finally, although this isn't directly a NuMI project concern, it certainly is for the MINOS experiment. That is, understanding the losses in the Main Injector for NuMI operations. As pointed out in one viewgraph, the losses associated with a multiwire being in the beam bring residual radiation levels in the nearly component up to over 1 R/hr. Extrapolating that to the Main Injector, beam losses of 1% would result in over 100 R/hr. The machine becomes unserviceable. The present ~90% efficiency needs to be improved. Just as the MiniBooNE people have worked with the Proton Source to help understand and reduce losses, the NuMI people need to look at the same issues in the MI.